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EXAMINER	
CHANG, EDITH M	

ART UNIT	PAPER NUMBER
2637	

DATE MAILED: 08/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/938,453	HUANG ET AL.	
	Examiner	Art Unit	
	Edith M. Chang	2637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 April 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15,17-24,29,35-39,41 and 42* is/are rejected.

7)☒ Claim(s) *16,25-28,30-34 and 40* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *20050225*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments/Remarks

1. The pages 14 to 20 of the Remarks filed on April 18, 2005 are mark at the left upper side as Serial No. 08/787,651; nevertheless, this office action is for Serial No. 09/938,453 as the following.

2. Applicant's arguments filed on April 18, 2005, have been fully considered but they are not persuasive.

Argument: Applicants are not really sure what is meant by u antennas.

Response: Baum et al. discloses a MIMO system having a plurality of transmitted antennas and a plurality of receive antennas in FIG.1, the receiver having multiple branches for receiving in FIG.4, however does not explicitly show the multiple transmitting branches. Odenwalder et al. teaches/shows the different Walsh codes (channels) used on the multiple antennas that is one Walsh code (channel) on one antenna (column 2 lines 36-40 of Odenwalder). Hence u (multiple) antennas for u Wash codes used in the Baum et al.'s system (FIG.2 & section [0022] lines 10-12 of Baum).

Argument: Applicants invention employs only a single, joint equalization element which operates on the signal received from all of the antennas together.

Response: The "only a single, joint equalization element which operates on the signal received from all of the antennas together" does not recite in the claims.

Baum et al. discloses a receiver and its method determining a joint equalizer solution using channel information for *at least one* pairing of *at least one* of said transmit antennas and said receive antennas in FIG.4, as recited in the claims.

Argument: Applicants' joint equalizer produces a number of output streams based on the number of transmit antennas.

Response: The limitation "joint equalizer produces a number of output streams based on the number of transmit antennas" does not recite in the claims. Baum et al. teaches and suggest determining a joint equalizer solution using channel information for *at least one* pairing of *at least one* of said transmit antennas and said receive antennas in FIG.4 as recited in the claims.

Argument: regarding dependent claims 11-14 and 17, Yakhnich et al. does not teach or suggests the element of a joint equalizer solution.

Response: Yakhnich et al. teaches the well-known soft bit mapping in the decoding stage of the receiver in a wireless communication system (column 1 lines 54-60), that Baum's system is for CDMA wherein the CDMA receiver inherently provides the decoding stage to decode (bit map) the received equalized signal/samples with minimum error. At the time of the invention, it would have been obvious to one of ordinary skill in the art to have the *further* step of performing soft bit mapping using the equalized samples to recover the transmitted signal taught by Yakhnich et al., so that the decoding is efficient with the soft decision information independent of the type of equalizer used (column 5, lines 44-52 of Yakhnich).

Argument: Each of independent claims 18 and 42 contains a limitation similar to that of claim 1 which requires determining a joint equalizer solution using channel information for at least one pairing of at least one of the transmit antennas and the receive antennas.

Response: Baum et al. discloses a receiver and its method determining a joint equalizer solution using channel information for *at least one* pairing of *at least one* of said transmit antennas and said receive antennas in FIG.4, as recited in the claims.

Claim Objections

3. Claims 2-41 are objected to because of the following informalities:

Claims 2-17, line 1: "The invention" should be "The method".

Claim 14, line 2: "soft mapping" should be "soft bit mapping".

Claim 18, line 2: "of signal detectors" should be "of M signal detectors"; line 3: "signal sources" should be "N signal sources".

Claims 19-41, line 1: "The invention" should be "The receiver".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 1-10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. (US 2002/0126741 Al) in view of Odenwalder et al. (US 6,795,508 B1).

To **claims 1** & **15**, Baum teaches a multiple-input multiple-output (MIMO) system in FIG. 1, the base stations 110 with multiple antennas sending multiple signals and receivers 130 with multiple antennas receiving the multiple transmitted signals; in FIG. 2 the transmitter transmits signals d_1 to d_u over a channels (spreaded by WALSH CODE Wt to W_u); in FIG.4 the receiver

receives the samples of the transmitted signals from 405s and detects received signals by different branches 310s. In FIG. 4, the receiver comprising:

the joint equalizer, element 330 apply equalizer gain values means (page 5 section [0054] lines 1-3) that determines and applies the joint equalization solution for respective pair of the received signal transmitted over one channel (indexed by k) and the receiver branch (indexed by i) shown in

equations 16 and 17 in page 5 sections [0053] and [0058] at i^{th} receiver branch and k^{th} transmitted signal wherein the H is the impulse response of the channel.

However, Baum does not explicitly specify the transmitted signals over multiple channels being over multiple antennas. Odenwalder teaches in a CDMA system different Walsh codes used on the multiple antenna, code symbols being transmitted using one Walsh code on one antenna in FIG. 1 and column 2 lines 33-38. As Baum using different Walsh codes for different channel in a CDMA communication system, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have one Walsh code channel over one antenna taught by Odenwalder in Baum's method and system for transmission and equalization for wideband CDMA for the purpose of having a improved method and apparatus for providing diversity transmissions to a receiving unit (column 1 lines 10-17).

To claim 2, Baum teaches the minimum mean square error (MMSE) solution at page 5 section [0057].

To **claim 3**, Baum teaches the estimating a channel for at least one paring of the transmit antenna and the receive antenna in FIG. 9 step 910.

To **claim 4**, Baum teaches the estimating a channel for at least one paring of the transmit antenna and all receive antennas stated in page 2 section [0019] and FIG. 1 wherein one base station being the transmit antenna to all user devices 120 & 130 in the region (page 5 section [0053] wherein the receiver has an M number of receive antennas). The step 910 of FIG.9 estimates a channel for at least one paring of the transmit antenna and all receive antennas.

To **claim 5**, Baum teaches determining the equalization solution in frequency domain in FIGA elements 325 and 330; and equation 10 in section [0046].

To **claim 6**, Baum teaches applying the equalization solution in the time domain in equation 11 in section [0048], steps 960-970 FIG.9, and FIGA elements 335, 340 and 345.

To **claim 7**, Baum teaches applying the equalization solution performed in the frequency domain in FIG.4 elements 325 and 330 to the received samples.

To **claim 8**, Baum teaches dispreading the equalized signals by spreader 345 of FIG.4.

To **claim 9**, the modified/combined Baum method with Odenwalder's teaching teaches at least two of the transmit antennas transmit at different carriers (column 2 lines 22-25).

To **claim 10**, Baum teaches using different transmit constellations, e.g. QAM or PSK in section [0020].

6. Claims 11-14 and 17 are rejected under 35 U. S. C. 103(a) as being unpatentable over Baum et al. (US 2002/0126741 A1) in view of Odenwalder et al. (US 6,795,508 B1) as applied to claim 1 above, and further in view of Yakhnich et al. (US 6,731,700 B1).

To **claim 11**, Baum does not specify the soft bit mapper of a decoder. Yakhnich teaches a decoder with the soft value generator/mapper in FIG.2 and FIG.5 and the posteriori probability algorithm (column 11 lines 17-25). As Baum dispreading the received coded wireless signal, and Yakhnich teaching decoding the despreaded signal from the demodulator, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have the decoder with the soft value generator taught by Yakhnich (elements 58 and 60 of FIG.2) in Baum's receiver to receive the despreaded data 350 of FIG.3 to decode the coded signal to recover the transmitted signal for the purpose of having an efficient decoding with the soft decision information independent of the type of equalizer (column 5 lines 44-52 '700).

To **claim 12**, Baum teaches dispreading the equalized signals by spreader 345 of FIG.4.

To **claim 13**, the modified Baum method with Yakhnich's teaching teaches making the noise equal as the zero means white noise in the posteriori probability's soft mapping in column 12 lines 20-30 ('700).

To **claim 14**, the modified Baum method with Yakhnich's teaching teaches performing a posteriori probability metric (column 10 lines 66-67 & column 11 lines 17-25) on the samples from the inner decoder/equalizer (column 2 lines 27-30 '700).

To **claim 17**, the modified Baum method with Yakhnich's teaching teaches to minimize the ISI as the equalizer solution in column 2 lines 25-30 of Yakhnich '700.

7. Claims 18-24, 29, 35-39, 41 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. (US 2002/0126741 Al) in view of Yakhnich et al. (US 6,731,700 B1) and Odenwalder et al. (US 6,795,508 B1).

To claims **18** & **42**, Baum teaches a multiple-input multiple-output (MIMO) system in FIG. 1, the base stations 110 with multiple antennas sending multiple signals and receivers 130 with multiple antennas receiving the multiple transmitted signals; in FIG.2 the transmitter transmits signals dl to $d_{„}$ over a channels (spreaded by WALSH CODE W_1 to W_u) in FIG.4, the receiver detects received signals by different branches. In FIG.4, the receiver comprising:

the joint equalizer, element 330 apply equalizer gain values means (page 5 section [0054] lines 1-3) that develops a joint equalization solution for respective pair of the received signal transmitted over one channel (indexed by k) and the receiver branch or antennas (page 5 section [0053], indexed by i) shown in equations 16 and 17 in page 5 sections [0053] and [0058] at i^{th} receiver branch and k^{th} transmitted signal as an order control in page 8 section [0092] lines 5-9.

However, Baum does not specify the decoder. Yakhnich teaches the decoder with the soft value generator in FIG.2 and FIG.5 and the posteriori probability algorithm (column 11 lines 1725). As Baum dispreading the received coded wireless signal, and Yakhnich teaching decoding the despreaded signal from the demodulator, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have the decoder with the soft value generator taught by

Yakhnich (elements 58 and 60 of FIG.2) in Baum's receiver to receive the despread data 350 of FIG.3 to decode the coded signal to recover the transmitted signal for the purpose of having an efficient decoding with the soft decision information independent of the type of equalizer (column 5 lines 44-52).

And Baum does not explicitly specify the transmitted signals over a channels being over a antennas, it is well known that the in a CDMA system different Walsh codes used on the multiple antenna, code symbols being transmitted using one Walsh code on one antenna as taught by Odenwalder in FIG. 1 and column 2 lines 33-38. As Baum using different Walsh codes for different channel in a CDMA communication system, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have one Walsh code channel over one antenna taught by Odenwalder in Baum's method and system for transmission and equalization for wideband CDMA for the purpose of having a improved method and apparatus for providing diversity transmissions to a receiving unit (column 1 lines 10-17).

To **claim 19**, Baum teaches the minimum mean square error (MMSE) solution at page 5 section [0057).

To **claim 20**, the modified Baum method with Yakhnich's teaching teaches performing a posteriori probability metric (column 10 lines 66-67 & column 11 lines 17-25 '700) on the samples from the inner decoder/equalizer (column 2 lines 27-30 '700).

To **claim 21**, the modified Baum method with Yakhnich's teaching teaches making the noise equal as the zero means white noise in the posteriori probability's soft mapping in column 12 lines 20-30 ('700).

To **claim 22**, Baum teaches dispreading the equalized signals by spreader 345 of FIG.4.

To **claim 23**, the modified/combined Baum method with Odenwalder's teaching teaches at least two of the transmit antennas transmit at different carriers (column 2 lines 22-25 '508).

To **claim 24**, Baum teaches using different transmit constellations, e.g. QAM or PSK in section [0020].

To **claim 29**, Baum teaches that the joint equalizer, element 330 apply equalizer gain values means (page 5 section [0054] lines 1-3) develops a joint equalization solution for respective pair of the received signal transmitted over one channel (indexed by k) and the receiver branch (indexed by i) shown in equations 16 and 17 in page 5 sections [0053] and [0058] at i^{th} receiver branch and k^{th} transmitted signal as an order control in page 8 section [0092] lines 5-9, wherein the M receive elements as different signal detectors.

To **claim 35**, the modified/combined Baum's receiver with Odenwalder' teaching teaches that the signal sources and detectors are antennas (FIG.1, FIG.2 & FIG.4 Baum, FIG.1 '508).

To **claim 36**, Baum teaches the estimating a channel for each paring of the transmit antenna and the receive antenna in FIG. 9 step 910 and page 8 section [0092].

To **claim 37**, Baum teaches the equalizer having the equalization solution in frequency domain in FIGA elements 325 and 330; and equation 10 in section [0046].

To **claim 38**, Baum teaches the equalizer having the equalization solution in the time domain in equation 11 in section [0048], steps 960-970 FIG.9, and FIG.4 elements 335, 340 and 345.

To **claim 39**, Baum teaches developing and applying the equalization solution in a frequency domain in FIG.4 elements 325 and 330; and applying the obtained MMSE solution in the time domain in FIG.4 elements 335, 340 and 345.

To **claim 41**, the modified Baum method with Yakhnich's teaching teaches to minimize the ISI as the equalizer solution in column 2 lines 25-30 of Yakhnich '700.

Allowable Subject Matter

8. Claims 16, 25-28, 30-34 and 40 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and overcome the objections set forth in this office action.

9. The following is a statement of reasons for the indication of allowable subject matter:
The prior art of record fails to teach or suggest, alone or in a combination, among other things, at least a receiver used in MIMO system for compensating for time dispersion and its method as a whole, the combination of elements and features, which includes a buffer-subtractor coupled between a joint equalizer and signal detectors, and between a space time regenerator and the joint equalizer to subtract a representation of signals for a currently being processed transmit antenna for each iteration for each one of transmit antennas.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edith M. Chang whose telephone number is 571-272-3041. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay K. Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Edith Chang
August 18, 2005

YOUNG T. TSE
PRIMARY EXAMINER